



PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Goguen et al.

Examiner: Baran

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For: Output Performance Trends of a Mass Storage System

#10
S. Ranga
8/10/03

CERTIFICATE UNDER 37 C.F.R. § 1.8(a)

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RESPONSE TO FINAL OFFICE ACTION

In the final office action dated February 14, 2003, the Examiner (1) rejected Claims 1, 2 and 5-9 under 35 U.S.C. §103(a) as being obvious over U.S. Patent No. 5,623,598 issued to Voigt et al. ("Voigt") in view of U.S. Patent No. 6,128,717 issued to Harrison et al. ("Harrison"), and (2) rejected Claims 3 and 4 under § 103(a) as being unpatentable over Voigt in view of Harrison and further in view of U.S. Patent No. 5,586,059 issued to Oshelski et al. ("Okhelski"). Reconsideration and allowance of the application are requested.

The Examiner rejected Claims 1, 2 and 5-9 under 35 U.S.C. §103(a) as being obvious over Voigt in view of Harrison. The Examiner contends that Voigt discloses all

the limitations of independent Claim 1 except for a controller connected to a plurality of host computers. The Examiner states that Harrison discloses a controller (interface structure 14) which is connected to a plurality of host computers (i.e., network environment).

The present invention is directed to a method of presenting system performance to a user in a mass storage system having multiple disk drive storage elements controlled by a disk drive controller. During operation, the disk drive controller receives commands and data from and returns data to a plurality of host computers. To determine performance of the system, the host computers can be operated to test the controller and the disk drive elements. Accordingly, potential problems that can create a bottleneck on those communication lines connected from the controller to either the disk drive elements or the hosts can be identified.

As noted in the specification on page 1, it is well known in the field to measure, typically using a single parameter, the instantaneous or average response time of a system. Typically, a host computer outputs one or more I/O requests to the disk drive controller, and then measures the time for a response to be received from the disk drive controller. This time duration, while representative of the response of a specific read or write command to the disk drive system, is most often not representative of the actual performance that can be obtained from the system.

The performance of a large storage system is particularly difficult to measure since more than one of the host computers, which connect to the disk drive controllers, can operate at the same time, in a serial or in a parallel fashion. As a result, a plurality disk drive elements, usually arranged in a disk drive array, operating in either an independent fashion, a RAID configuration, or a mirrored configuration, e.g., can have a significant yet undetectable bandwidth or operational problem that cannot be addressed or discovered when commands are sent only from a single host computer.

Voigt discloses a system for identifying methods of improving performance in a data storage system having a single host computer station connected to a data storage system having an array of storage disks. Voigt discloses selecting a performance metric to be measured during operation of the data storage system. Voigt then samples the performance metric during operation of the data storage system either in the data storage system 14 or in the single host computer station 12. (columns 5-6).

Voigt does not disclose or in any way suggest a disk drive controller receiving commands and data from and returning at least data to a plurality of host computers. Furthermore, Voigt does not disclose or in any way suggest (1) executing at a plurality of host computers a test request by sending commands to the mass storage system, or (2) accumulating, at the executing host computers, data regarding performance of the mass storage system in response to the requests sent by the host computers. As previously noted, significant performance issues (e.g., undetectable bandwidth or operational problems) cannot be addressed or discovered when commands are sent only from a single host computer.

The Examiner cited Harrison as disclosing a controller connected to a plurality of host computers. Harrison discloses a method of recording data onto a disk drive by categorizing the data into data types. Harrison is not directed to solving or even recognizes the problem of determining or presenting system performance to a user of a mass storage system, much less the problems associated measuring performance using a single host computer. The Examiner cites col. 5, lines 46-53 of Harrison for teaching that providing performance data for a plurality of hosts can enhance the overall performance of a storage system. This portion of Harrison, however, only discloses an internal data object analysis process that analyzes data objects being sent to a disk drive from hosts and stores the data objects at particular storage locations of the disk drive to provide access performance depending on the type of data object. This does not in any way relate to (1) executing at a plurality of host computers a test request by sending commands to the mass storage system, or (2) accumulating, at the executing host

computers, data regarding performance of the mass storage system in response to the requests sent by the host computers.

The Examiner attempts to cure the defects of Voigt by combining it with the teachings of Harrison. However, combining Voigt and Harrison is the kind of hindsight that courts have repeatedly held is improper and impermissible. The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. In the present application, the prior art provides no teaching, suggestion or motivation to combine the performance improvement system of Voigt with the data recording and categorizing system of Harrison. As a result, there would have been no motivation to combine Harrison with Voigt. The combination of Voigt and Harrison is thus improper and fails to make a prima facie showing of obviousness.

The remaining claims in the application are all dependent on Claim 1 and are also similarly allowable over the Voigt and Harrison references.

The Examiner rejected Claims 3 and 4 under § 103(a) as being unpatentable over Voigt in view of Harrison and further in view of Oshelski. Oshelski does not cure the deficiencies of Voigt and Harrison noted above. With respect to Claim 3, the Examiner contends that Oshelski discloses extracting and storing data in databases, and accessing the databases to analyze and display the data in user specified formats. Oshelski is directed to an automated data management system for analysis and control of photolithography equipment. Oshelski does not in any way relate to presenting system performance of a mass storage system. The reference does not teach or in any way suggest combination with Voigt and Harrison, making the combination improper under § 103(a).

Claims 1-9 are pending in the present application. As the application is now believed to be in condition for allowance, issuance of a Notice of Allowance is respectfully requested.

Respectfully submitted,



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